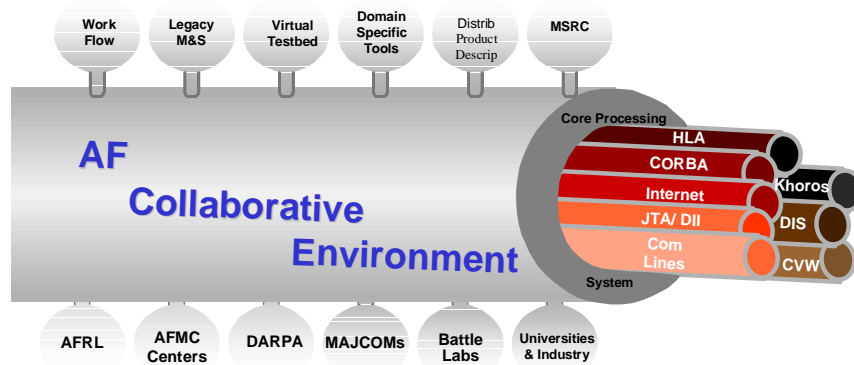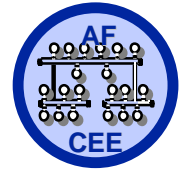# AFRL Collaborative Environment for Simulation Based Acquisition

Bill McQuay
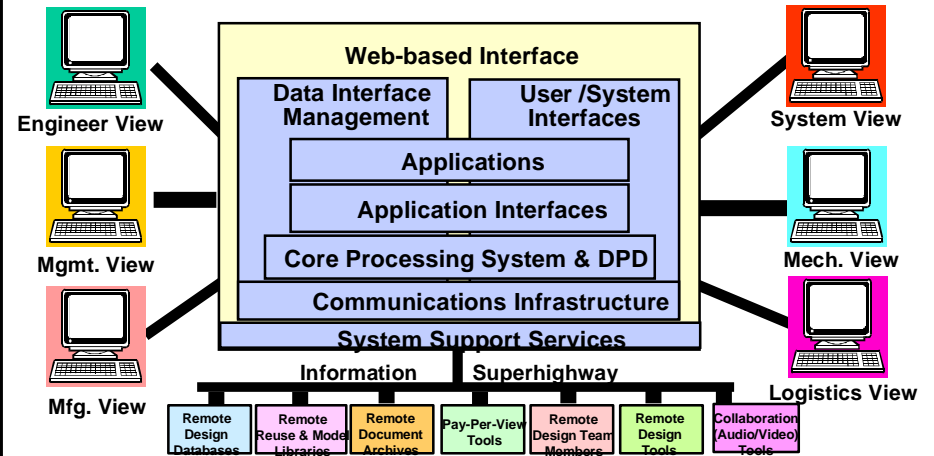
Collaborative Simulation Technology Branch
Information Systems Division
Information Directorate
AF Research Laboratory

Collaborative Enterprise Technology

Collaborative Environment Reference Architecture

Work Flow · Legacy M&S · Virtual Testbed · Domain Specific Tools · Distrib Product Descrip · MSRC

AF Collaborative Environment

Core Processing: HLA · CORBA · Internet · JTA/DII · Com Lines · Khoros · DIS · CVW

System

AFRL · AFMC Centers · DARPA · MAJCOMs · Battle Labs · Universities & Industry

Engineer View · System View · Mgmt. View · Mech. View · Mfg. View · Logistics View

Web-based Interface
- Data Interface Management
- User /System Interfaces
- Applications
- Application Interfaces
- Core Processing System & DPD
- Communications Infrastructure

System Support Services
Information Superhighway

Remote Design Databases · Remote Reuse & Model Libraries · Remote Document Archives · Pay-Per-View Tools · Remote Design Team Members · Remote Design Tools · Collaboration (Audio/Video) Tools

Objectives:

To apply advanced simulation and information technology and engineering tools, including virtual testbeds, in an collaborative environment as a decision support system for
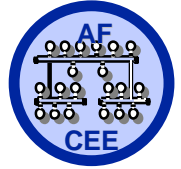- Simulation Based Acquisition
- Cross domain technology development
- System design and test and evaluation
- Distributed mission training
- Strategy & Planning

Payoff:

- Framework for SBA collaborations
- Cross discipline, multiple domain sharing, integration & evaluation in a system of systems context
- Enables Virtual Engineering & Test
- Provides structure for cost of function/ performance affordability trades
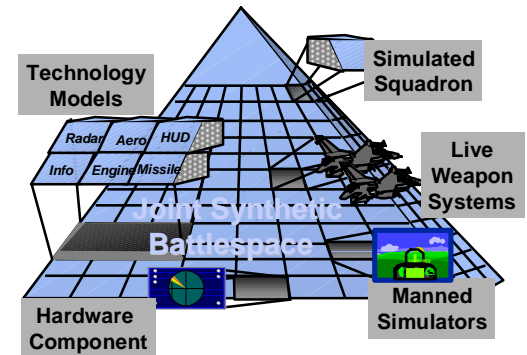- Enables collaboration with industry partners
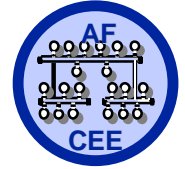
Simulation Based Acquisition

An Open, Distributed Collaborative System

- Integrated Product & Process Model
- Common Application Framework
- Underlying Communication Backbone
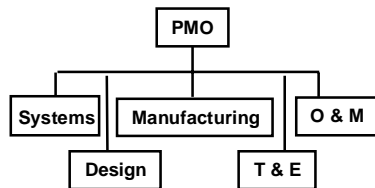- Virtual Products In Synthetic Environments

Technology Models

Radar Aero HUD
Info Engine Missile

Joint Synthetic Battlespace

Hardware Component

Simulated Squadron

Live Weapon Systems

Manned Simulators

- **A process supported by robust, collaborative use of simulation technology that is integrated across acquisition phases and programs**

- **"Try Before Buy" in a Virtual Environment**

- **Problem Solving Before System is Built & Across the Life Cycle**
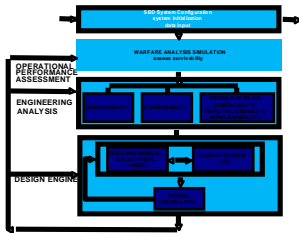
- **Tying Together the S&T, Acquisition, and User Communities**

CEE Vision

Data ➡ Information ➡ Knowledge ➡ Wisdom

Organization
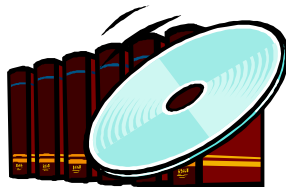
PMO

Systems | Manufacturing | O & M
Design | T & E

Engineering Process

Process for configuring a CEE
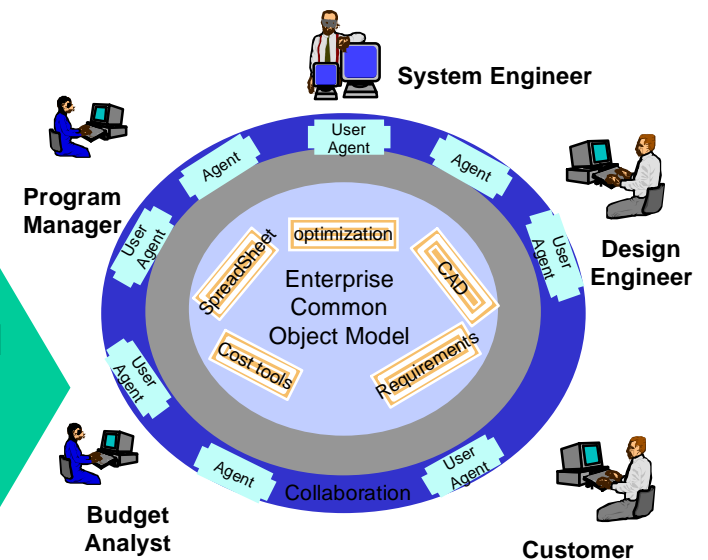
- Product/Process Model
- Tool Integration
- Data Mediation
- Work Flow
- Intelligent Agents
- Collaborative Framework

Tools

Data

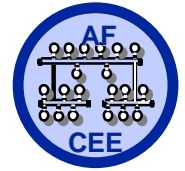System Engineer

Program Manager

Design Engineer

Agent
User Agent
User Agent
User Agent
User Agent
Agent
User Agent
Agent

SpreadSheet
optimization
CAD
Cost tools
Requirements
Enterprise Common Object Model
Collaboration

Budget Analyst

Customer
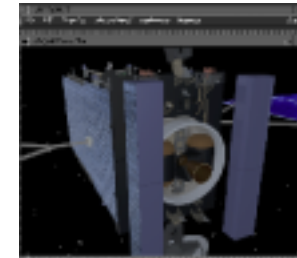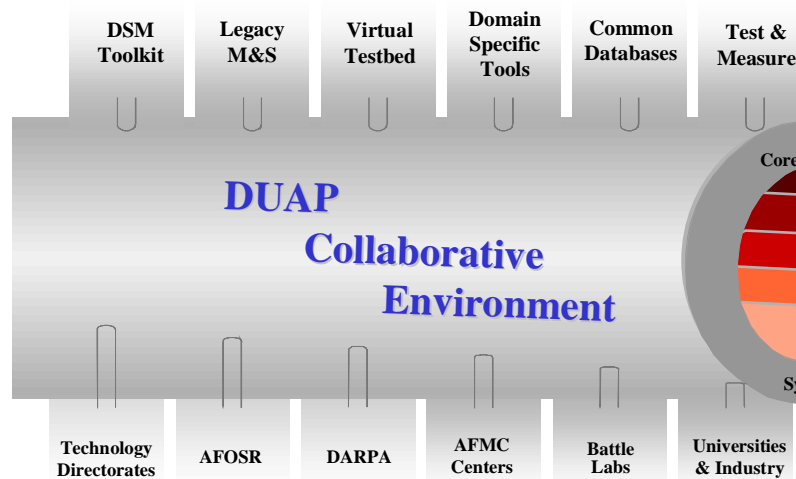
CEE

AFRL Collaborative Environment
Leveraging DARPA SBD & DUAP CEE

AF CEE

Enterprise Common Object Model/ Smart Enterprise Model

3D Visualization Web-based Viewers

| DSM Toolkit | Legacy M&S | Virtual Testbed | Domain Specific Tools | Common Databases | Test & Measure |

DUAP Collaborative Environment

Core Processing

| HLA |
| CORBA |
| Internet / Web |
| JTA/DII |
| Direct Lines |

Khoros

DIS

CVW

System

| Technology Directorates | AFOSR | DARPA | AFMC Centers | Battle Labs | Universities & Industry |

Workflow, Process Modeling, & Human Collaboration Tools

MUPE

Total Cost

Sub System: ADCS, EPS, TT&C, SMS, TCS, AKM

Affordability & Cost Tools

Subsystems Models

Systems Simulations

Graphical Displays

Data Analysis

Engineering & System Modeling (JWARS, JSIMS, JMASS, Legacy, COTS, HLA)

SBA Roadmap Reference System Architecture

SBA Reference System Architecture

User Environment

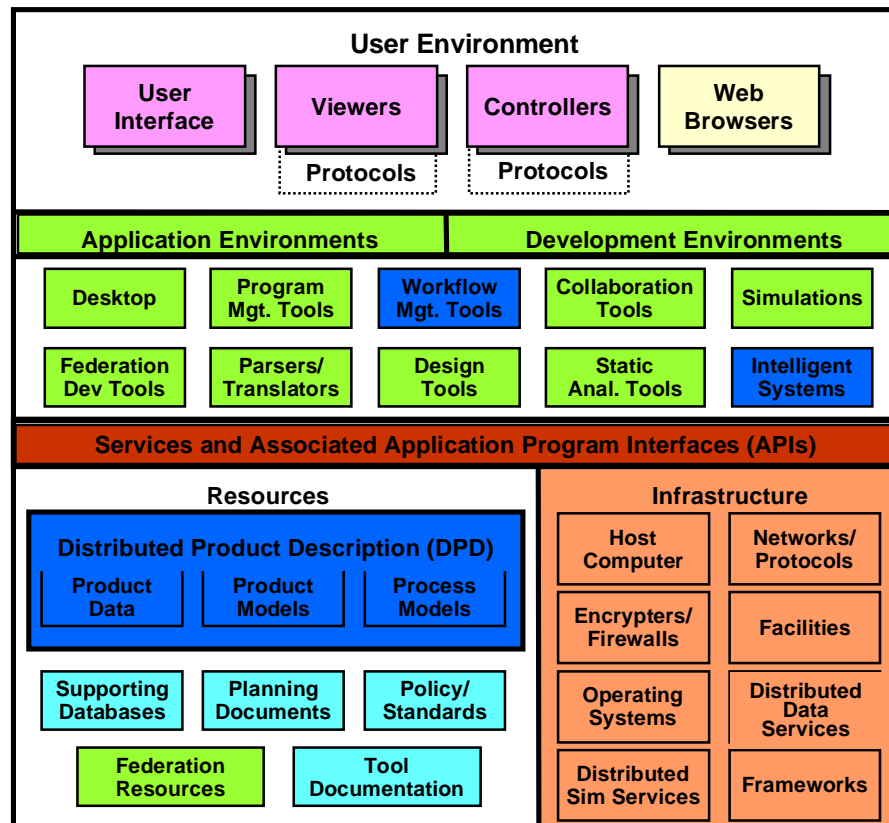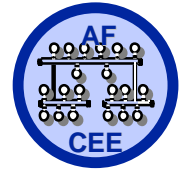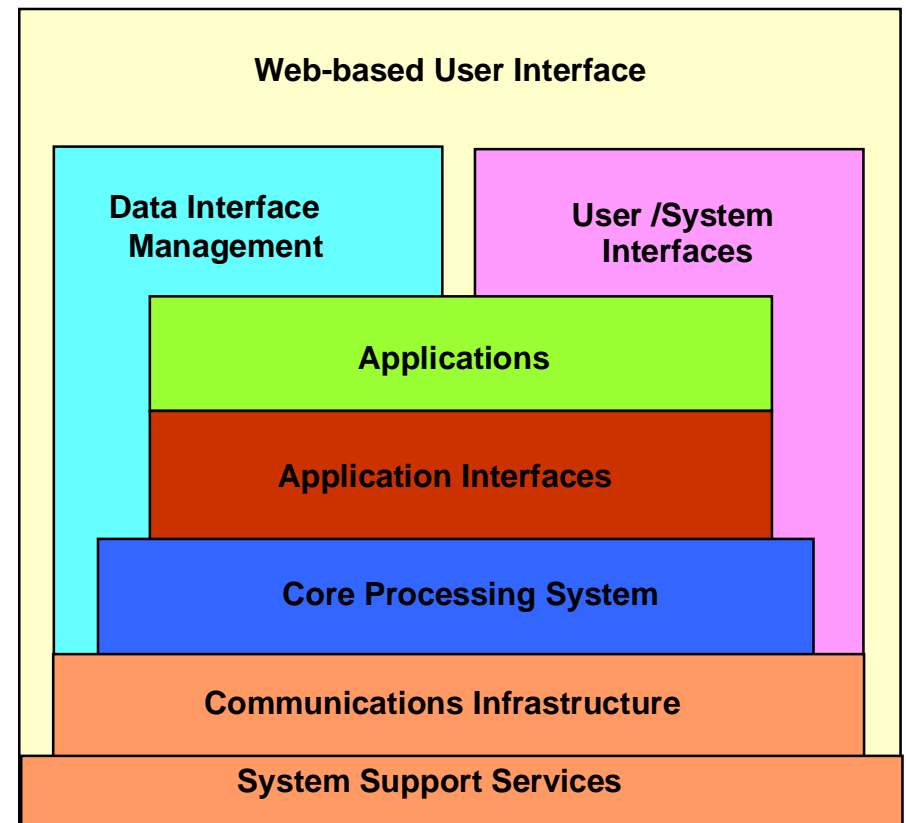| User Interface	Viewers	Controllers	Web Browsers
	Protocols	Protocols	

Application Environments | Development Environments

Desktop	Program Mgt. Tools	Workflow Mgt. Tools	Collaboration Tools	Simulations
Federation Dev Tools	Parsers/ Translators	Design Tools	Static Anal. Tools	Intelligent Systems

Services and Associated Application Program Interfaces (APIs)

Resources

Distributed Product Description (DPD)

Product Data	Product Models	Process Models

Supporting Databases	Planning Documents	Policy/ Standards

Federation Resources	Tool Documentation

Infrastructure

Host Computer	Networks/ Protocols
Encrypters/ Firewalls	Facilities
Operating Systems	Distributed Data Services
Distributed Sim Services	Frameworks

AFRL CE Reference Architecture

Web-based User Interface

- Data Interface Management
- User /System Interfaces
- Applications
- Application Interfaces
- Core Processing System
- Communications Infrastructure
- System Support Services

Color coded mapping to SBA Reference System Architecture

DUAP CEE Implementation - Oct 98

Client/GUI

Dynamic HTML | Applets | Appl.

User Domain Server

User Servlets | User Agents

Enterprise Mgmt Server

Enterprise Agents

Enterprise Common Object Model

ECOM

Resource Domain Server

Resource Agents | Resource Wrappers

Smart Enterprise Model Server

SEM

- Product Model
- Process Model
- Context Model
- Resource Model

HTTP-Based Communication Mgmt

CORBA-Based Communication Mgmt

Private Communication Mgmt

CEE Communication Backplane

Web Server(s)

CORBA-Based Services

Private Resources

Public Resources
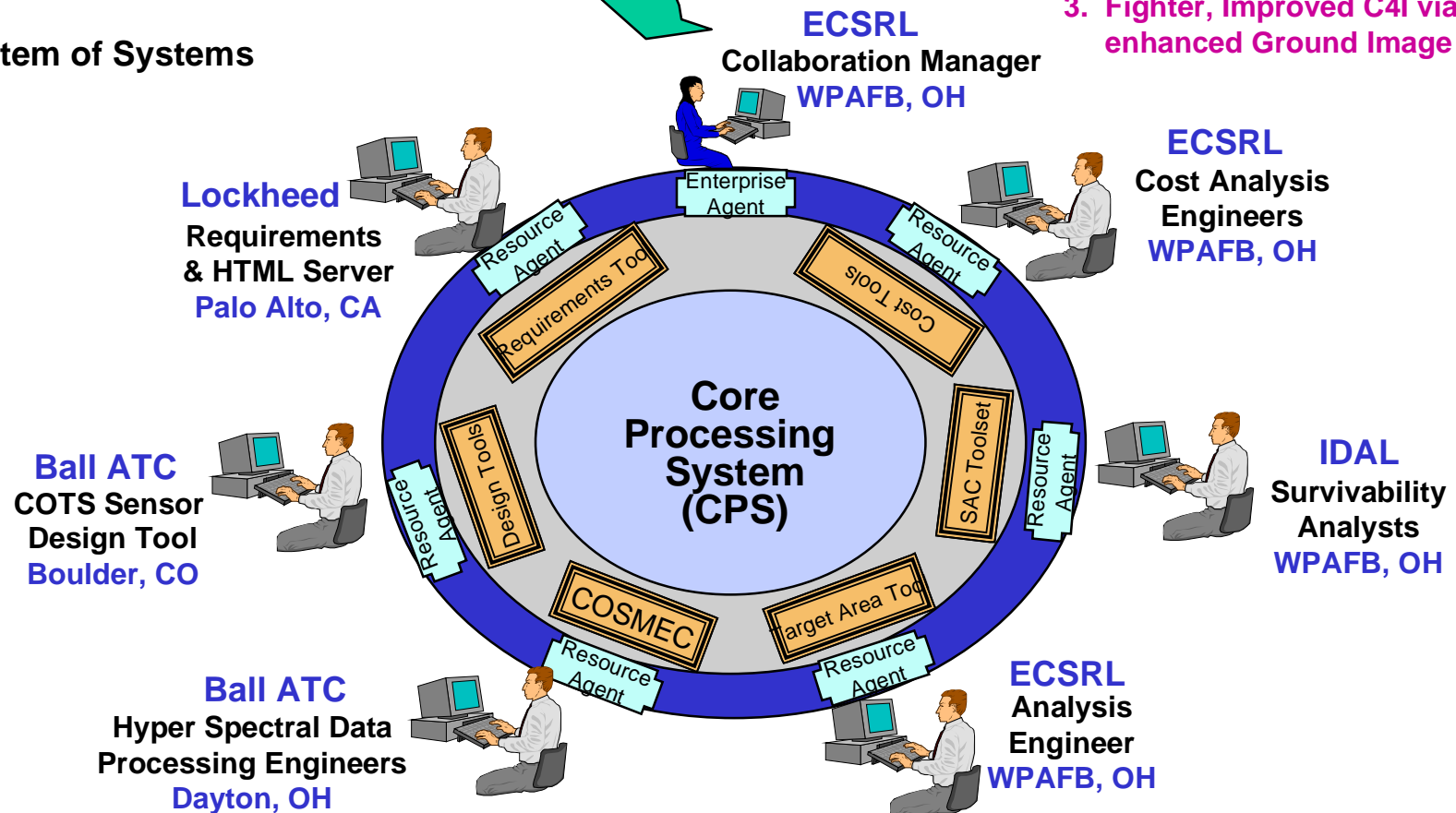
Sep 98 CE Experiment:
Sensor-DecisionMaker-Shooter-Weapon

Problem: Examined a limited set of technology alternatives to improve the ability to locate and destroy mobile targets.

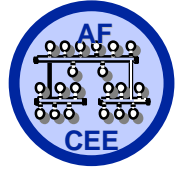**Collaborative Environment**

System of Systems

1. **Baseline Case: Fighter**
2. **Fighter, Off Board C4I Information**
3. **Fighter, Improved C4I via enhanced Ground Image S/W**

ECSRL
Collaboration Manager
WPAFB, OH

Lockheed
Requirements & HTML Server
Palo Alto, CA

ECSRL
Cost Analysis Engineers
WPAFB, OH

Ball ATC
COTS Sensor Design Tool
Boulder, CO

IDAL
Survivability Analysts
WPAFB, OH

Ball ATC
Hyper Spectral Data Processing Engineers
Dayton, OH

ECSRL
Analysis Engineer
WPAFB, OH

Enterprise Agent

Resource Agent

Requirements Tool

Cost Tools

Design Tools

Core Processing System (CPS)

SAC Toolset

COSMEC

Target Area Tool

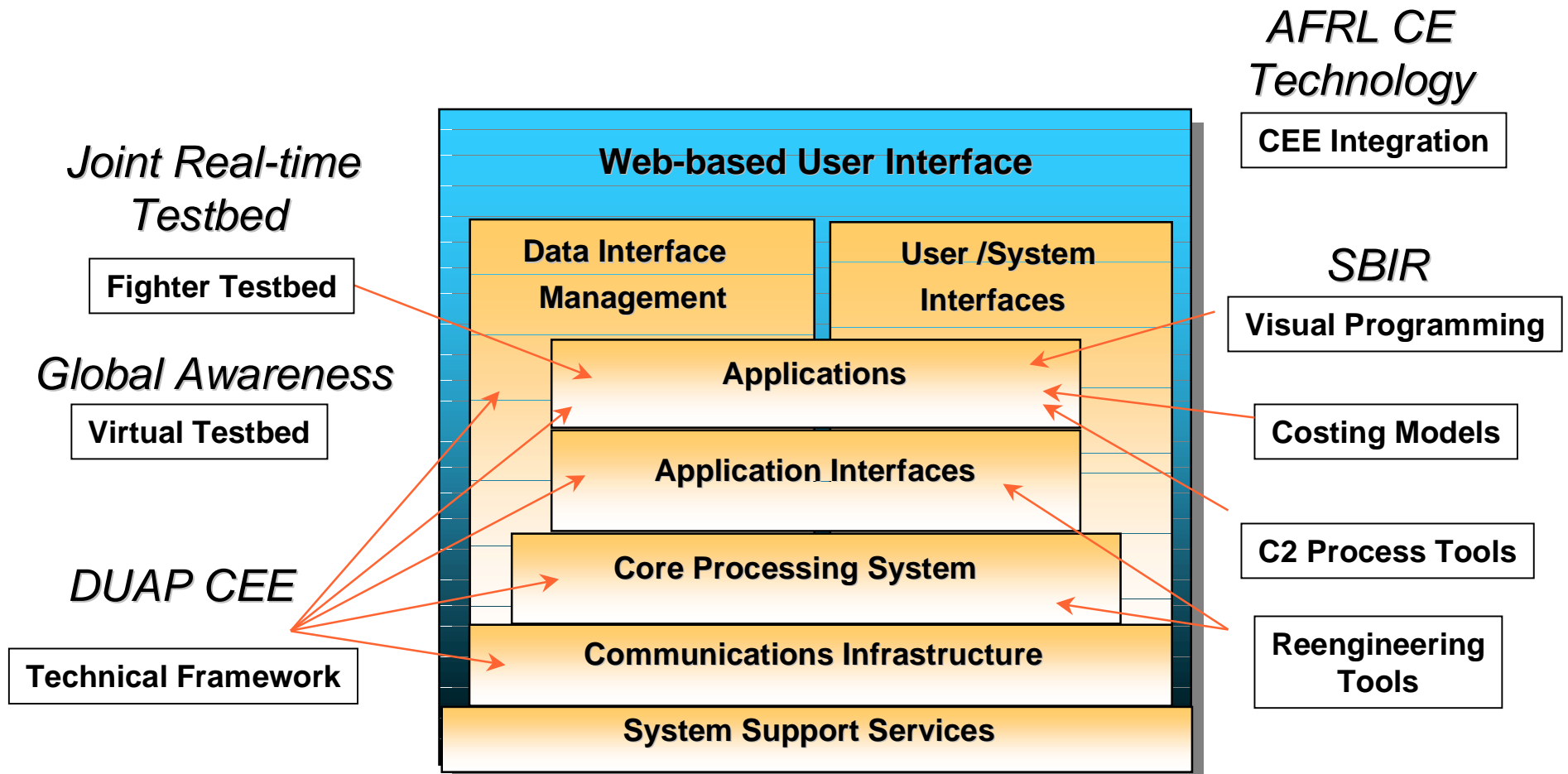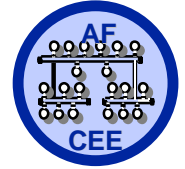Resource Agent

Fall 99 Spiral Development Goals

- **Architecture Enhancements:**
  - **Workflow**
  - **Variable Thickness GUI**
  - **CORBA Services**
  - **Product & Process Model Tools**
  - **Multiple ORB Support** (DCOM, Java…)
  - **Human Collaboration Tools**

- **Experiment:**
  - **Expand Command & Control capabilities with constructive simulation**
  - **Incorporate Space Based Radar Simulation**
  - **Incorporate Producibility & Virtual Manufacturing Assets**
  - **Demonstrate Enhanced Synchronous Collaboration Support**
    - **Real-time Mission Model**
    - **Man/Hardware-in-the-loop Simulators**
  - **Demonstrate compliance with High Level Architecture (HLA)**
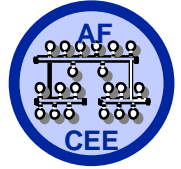 - **Access High Performance Computer (HPC) Resources For Military Worth Analysis**

Collaborative Enterprise Environment
Current Technology Development Programs

AFRL CE Technology

CEE Integration

Joint Real-time Testbed

Fighter Testbed

Global Awareness

Virtual Testbed

Web-based User Interface

Data Interface Management	User /System Interfaces

Applications

Application Interfaces

Core Processing System

Communications Infrastructure

System Support Services

SBIR

Visual Programming

Costing Models

C2 Process Tools

Reengineering Tools

DUAP CEE

Technical Framework

Advancing CEE Architecture And Applications

21st Century Aerospace
A Vision for Distributed Collaborative Environments